

# Digital Inverter Pulsed Gas Metal Arc Welding Machine



MIG 280 PLUS

## Operation Manual



Read this manual carefully before installing, operating and maintaining the machine.



Description: This machine is designed and built to weld ferrous and non-ferrous metals.

Disclaimer: The information, illustrations and instructions described in this manual are based on the latest product information available at the time of publication. The manufacturer and distributors reserve the right to modify the contents of this manual at any time. Modifications may result following product modifications and the manufacturer and distributors are not obliged to notify any organization or individual of such modifications. Welding work must be executed only by professionally trained and qualified individuals. Therefore, the manufacturer and distributors will only accept responsibility for product quality. No liability, joint or several, shall be accepted for incidents including but not limited to loss of profit resulting from omissions or misdirection that may be printed in this operation manual. This manual will contain as far as possible preventive and safe operation measures related to the equipment but cannot exclude the occurrence of accidents. Therefore, the manufacturer and distributors shall not be liable for any direct or indirect, joint or several liability for any incidental or consequential damages which may occur. For detailed health and safety information, the relevant professional agencies and manufacturers of consumables such as welding materials and flux should be contacted.

### **Warranty Exclusions:**

- ✓ Consumable items such as welding wires, welding flux, fuses, quick connectors, drive rollers, tension rollers, etc.
- ✓ Machine damages caused by incorrect voltage input or power surges.
- ✓ Machine or parts malfunction owing to incorrect connections or user operation.
- ✓ Illegal disassembly or re-fitment of the machine without permission of the manufacturer, resulting in damage or malfunction.
- ✓ Accidental damage during shipment, transportation and storage.
- ✓ Damage owing to incorrect handling, natural disaster and other force majeure occurrences.

# CONTENTS

 Safety Precautions .....	3
 Warnings .....	4
Packaging and Transportation .....	7
Parameters .....	8
Product Description .....	8
Working Principle.....	16
Installation and Wiring .....	17
Brief Procedure for Welding Operation .....	27
Maintenance .....	30
Common Machine Malfunctions and Solutions.....	30

## **Safety Precautions**

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The equipment is designed for use by qualified personnel who have completed professional training and have obtained a qualification certificate as a welder/cutter. The operator shall have sufficient professional knowledge of welding, cutting and circuitry. The machine should be operated only after having read and fully understood all the safety precautions and warnings contained in this manual and those generally applicable to welding operations. The risk of personal injury and damage to equipment is reduced by safety precautions being followed when using tools and equipment. This machine is easy to operate and the selection of its functions is straight forward. Improper use and maintenance will reduce the safe operation of the machine and the following safety precautions must be followed:

1. The operator must be suitably qualified and certificated before operating the equipment.
2. A qualified professional should be employed to ensure that the machine and all cables are properly connected, grounded and installed.
3. Personal protective equipment approved by the local safety authority must be used. All relevant safety procedures must be adhered to.
4. Before operation, insulation layers on wires and cables as well as connection sequences should be inspected and corrected if required.
5. Repairs and maintenance should be carried out by qualified technicians only after the machine has been disconnected from the electricity supply.
6. Operating the machine in a humid environment may result in a short circuit or may cause an electric shock to the operator.
7. Modifications to the machine or equipment are not allowed.
8. The disposal of scrap machine parts and equipment must comply with local regulations.

## Warnings

Welding and cutting operations are specialised operations which present a certain degree of risk. Professional training, correct operating procedures and protective measures reduce the accident risk and damage to equipment.

### Personal Safety Protection



**Welding and cutting operations generate noise, bright light and high-temperature sparks which will cause harm to human hearing, eyes and skin unless personal protective measures are implemented and proper operational instructions are adhered to.**

1	Wear flame retardant personal protective equipment (PPE) such as gloves, overalls, welding/cutting helmets, shoes and aprons to protect against thermal radiation, sparks and hot metal particles.
2	Hot sparks and metal fragments can cause skin damage. Avoid clothes with front pockets and button-up sleeves and collars.
3	Use appropriate flame-retardant shields or curtains to protect bystanders from arc radiation and high temperature sparks. Bystanders also need to wear a protective helmet fitted with a shading filter to protect face and eyes or a pair of spectacles fitted with shading filters.
4	Avoid burns and scalds by not touching a welded work piece with bare hands.

### Fire and Explosion Hazards



**Welding and cutting operations generate high-temperature flames and arc which can cause fires and explosions. The same applies to welding slag and sparks.**

1	Operators and bystanders must be protected from arc, sparks and metal fragments.
2	The welding/cutting area should be free from flammable and explosive materials. Should these materials be required in the welding/cutting process, flame retardant covers should be applied.
3	Care should be taken to avoid fire hazards from cracked floors and walls.

4	Welding and cutting on sealed gas tanks will cause explosions. These operations are prohibited.
5	Welding and cutting areas must be provided with adequate fire extinguishing equipment. Regular testing for efficiency of this equipment is compulsory as is training of staff in the use of the equipment.
6	Once the welding/cutting operation is completed, check for any high temperature spark or metal which might cause a fire and immediately dispose of it. If necessary, employ the assistance of a firefighter.

### Electricity Hazards



**Electric shock can cause serious injury or even death to the individual when contact is made with live wires. Humid conditions can add to the risk and great care should be taken when welding or cutting machines are used in these conditions.**

1	Reliable grounding of machine and work piece as well as a secure ground clamp, is important.
2	Insulation layers of electric wires and cables must be checked regularly for wear and replaced if necessary.
3	All equipment used and clothing worn during the welding/cutting operation should be free from moist and kept dry.
4	Do not make direct body contact with any live electrical parts.
5	Wearing rubber-insulated shoes and standing on an insulated platform greatly reduce the risk of accidental shock.
6	Refrain from replacing the ground cable on the machine with wires not suitable for the task.
7	The machine operates on high voltage and capacitors remain charged even after power is switched off. Removing covers for maintenance procedures must only be executed by qualified professionals.

### Effects of Electromagnetic Fields



**Electric current flowing through a conductor produces magnetic fields (EMF). The discussion on the topic of the effects of EMF on the human body is ongoing worldwide and up to the present no evidence has been forthcoming proving negative effects on health.**

**However, it would be wise to limit exposure to EMF as far as possible and the following procedures are suggested:**

1	Welders and cutters with cardiac pacemaker implants should obtain medical advice on the effects of EMF on the implant.
2	Welders should minimise the possibility of electromagnetic field damage through the following methods.
2.1	Route the electrode and ground cables together and, where possible, secure them with tape.
2.2	Do not wrap wires and cables around arms or coil power cables around body parts. If possible, keep cables away from the body.
2.3	Keep the distance between the ground clamp to the workpiece and the electrode as short as possible.
2.4	Keep a safe distance between the operator and the welding/cutting machine.

### **Protection from Fumes and Gases**



**During the welding or cutting process, fumes can be produced which may be detrimental to health.**

1	The working area should be well ventilated and welding/cutting activities should not be executed in confined spaces. Eye, nose or throat discomfort can be the result of inadequate ventilation.
2	Welding and cutting in or near locations where chlorinated hydrocarbon vapours are produced such as degreasing, cleaning and spraying operations, should not be undertaken since phosgene, a highly toxic gas as well as other irritants can be reaction products.
3	The industry offers a variety of respiratory masks and must be used in conditions where clean breathing air is required.

### **Gas Cylinder Safety**





**Gas leaks can occur on cylinders connected to welding/cutting operations if the system is not properly managed and maintained. A ruptured cylinder or relief valve can cause serious injury or can even be fatal.**

1	Gas cylinders should be kept away from extreme temperatures and fire sources. Scratching on cylinder walls with hard objects should be avoided.
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2	A pressure regulator should be installed on the gas cylinder in use in accordance with the manufacturer's operating instructions. Quick-coupling connectors must not be used and gas hose fitting should be tested for leaks.
3	Gas cylinders must always be kept upright and chained or belted to a cylinder trolley, base, wall, post or shelf. Never fix a gas cylinder to a worktable or machine: It can become party to an electrical circuit and explode.
4	Ensure that the cylinder valve is closed when not in use. If there is no hose connected to the cylinder regulator then cover the outlet with a dust cap.

### **Protection Against Moving and Rotating Parts**

		<b>Moving parts, such as fans, rotors and belts, can be hazardous.</b>
1	Ensure that all protective covers, doors and panels on the machine are closed or securely intact before starting an operation.	
2	Ensure that maintenance on machines are only carried out by qualified technicians.	
3	Ensure that hands, hair, clothing and tools are safely out of range from moving and rotating parts.	

## **Packaging, Transportation and Handling**

1. Pay attention to and comply with packaging, storage and transportation instructions which are clearly identified on the containers.
2. Always handle all containers with care.
3. Equipment must be stored in waterproof, moisture proof and well-ventilated facilities within the temperature range -25°C - 55°C.



## Parameters

Model	MIG-280	MIG-280PLUS
Parameters name	Value	
Rated input voltage:	AC380V±10% 50Hz 3PH	
Rated input power:	9.2kVA	9.2kVA
Rated input current:	14A	14A
Output current range:	10A~280A	10A~280A
Open circuit voltage:	70V	70V
Rated duty cycle:	60%	60%
Efficiency:	≥85%	≥85%
Wire diameter(mm):	Φ0.8~1.6	Φ0.8~1.6
Gas flow rate(l/min):	5~15	5~15
Insulation grade:	F	F
IP grade:	IP21S	IP21S
Package dimensions(mm):	980×540×790	980×540×1020
N.W.:	48kg	59kg

## Product Description

The welding machine in this series inverts the 50Hz power supply to a high-frequency, high-voltage power supply. The inversion process is facilitated by a powerful IGBT device followed by step-down rectification and pulse-width modulation (PWM) technology producing a high-power DC output suitable for welding. The advanced inverter technology allows for the construction of a smaller volume and light-weight, stable and reliable transformer with a 30% improved efficiency. Added to the advantages of the inverted power supply, the machine has good dynamic characteristics, and offers a stable arc, good welding quality and ease of control.

This semi-automatic, high-performance machine is designed for argon or carbon dioxide and mixed-gas welding on aluminium, aluminium alloys, low-carbon steel,

low-alloy steel, stainless steel and copper. Aluminium welding wire (4043/5356) and 0.8mm - 1.6mm diameter steel and stainless-steel wire as well as other solid or flux-cored wires can be used.

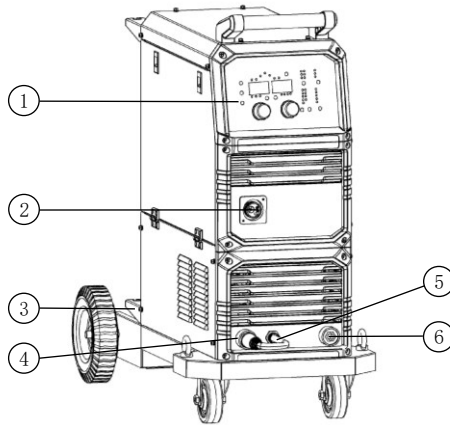
The inverter welding machines in this series are manufactured in accordance with IEC60974-1 <Arc Welding Equipment - Part 1: Welding Power Sources >, Safety Requirements for Arc Welding Equipment.

### **1. Product Functions and Features:**

- 1.1. All-in-one multiple welding functions served by a digital CPU control system delivering a precise digital output.
- 1.2. A reliable work performance and fast dynamic response is ensured by the IGBT high-frequency, soft-switching inverter technology.
- 1.3. A stable welding process and excellent arc self-regulation is ensured by the closed-loop control system regulating a stable voltage in cases of grid-voltage fluctuation.
- 1.4. Less spatter and a high metal-deposition rate.
- 1.5. Excellent weld-seam appearance and low heat-input distortion.
- 1.6. An excellent arc start resulting from an intense pulse-to-strike arc.
- 1.7. A wire feeding circuit which adopts a stable power supply ensuring smooth wire feeding.
- 1.8. Troubleshooting is minimised by the protection circuit ensuring safety and reliability.
- 1.9. Small size, light weight, high efficiency and reliable duty cycle as well as a noiseless arc produced by the rectifier.
- 1.10. Good structure, simple layout and ease of maintenance.

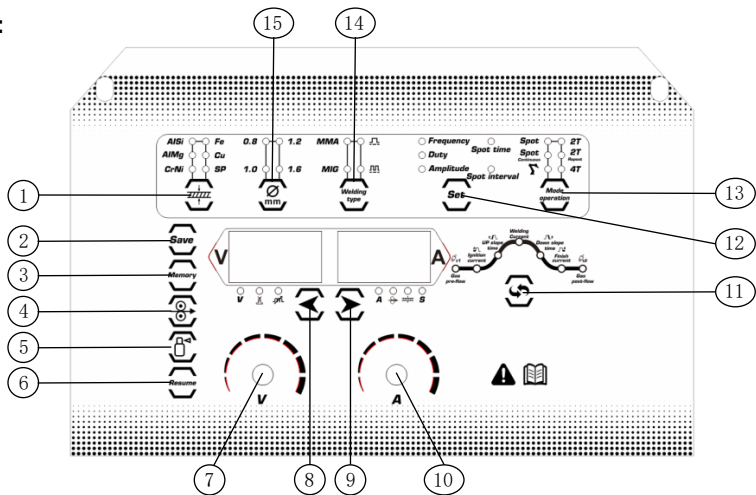
## 2. Appearance Diagram:

### MIG-280PLUS



<b>1</b>	<b>Control panel:</b> Welding parameter settings and display.
<b>2</b>	<b>Euro standard torch connector:</b> Connecting the welding torch.
<b>3</b>	<b>Gas cylinder fixed base:</b> Accommodating the gas cylinder.
<b>4 + 6</b>	<b>Terminal sockets - positive pole (+) and negative pole (-):</b> In MMA mode the electrode holder cable is connected to the positive terminal and the earth cable is connected to the negative terminal and should be reversed when using scratch start DC TIG in MMA mode. In MIG mode the polarity cable is connected to the positive terminal and the earth cable is connected to the negative terminal for all MIG welding applications, except for gasless flux-core welding where the polarity cable is reversed and connected to the negative terminal and the earth cable is connected to the positive terminal.
<b>5</b>	<b>Polarity conversion plug:</b> When using flux-cored wires the coupling device is connected to the negative pole.

**Panel:**



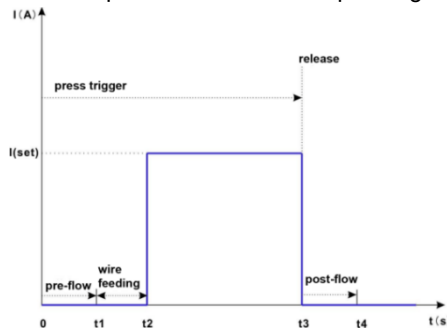
<b>1</b>	<b>Push-button - Welding Material:</b> Select between AlSi, AIMg, CrNi, Fe, Cu or SP and the selected material light will be turned on.
<b>2</b>	<b>Save-button:</b> Saves the completed welding parameters.
<b>3</b>	<b>Memory-button:</b> Ten sets (0 - 9) of adjusted welding parameters can be recalled and saved during each operation.
<b>4</b>	<b>Wire-feed-button:</b> Press and hold the feed button to start the wire feed. Releasing the button will stop the wire feed.
<b>5</b>	<b>Gas:</b> Press and hold the gas button to start the gas flow inspection. Releasing the button will stop the gas flow.
<b>6</b>	<b>Resume-button:</b> After holding this button depressed for 3 seconds, all parameters will be restored to factory values.
<b>7</b>	<b>Voltage-adjusting Dial:</b> Turning the dial will adjust the voltage output.
<b>8</b>	<b>Push-button - Left Menu:</b> Tapping this button will allow setting voltage, arc voltage and induction when the corresponding light is lit.
<b>9</b>	<b>Push-button - Right Menu:</b> Tapping this button will allow setting current, wire-feed speed, thickness and time when the corresponding light is lit.
<b>10</b>	<b>Current-adjustment dial:</b> Turn the dial to adjust the current output..
<b>11</b>	<b>Push-button - Select from parameters:</b> Tapping this button will allow setting values of pre-flow, ignition current, up slope, down slope, finish current and post-flow when the corresponding light is lit.

12	<p><b>Push-button - Select from parameters:</b> When <b>welding type</b> is selected as <b>double pulse</b>, selected as 'double pulse', short-pressing this key will adjust the corresponding value of frequency/ duty cycle/ amplitude when the relevant light is lit.</p> <p>When <b>Spot</b> is selected under <b>mode operation</b> short-pressing this key will adjust the welding time.</p> <p>When <b>spot continuous</b> is selected under <b>mode operation</b> short-pressing this key will adjust welding and interval time.</p>
13	<p><b>Push-button - Operation Mode Selection:</b> Switch trigger modes between 2T (without arc stopping), repeat 2T, 4T (with arc stopping), spot, continuous spot and communicate with the robot. When the corresponding light is lit, the selected mode is operational.</p>
14	<p><b>Push-button - Welding Type Selection:</b> Select between pulse MIG, double pulse MIG, standard MIG and MMA welding. When the corresponding light is lit, the selected mode is operational.</p>
15	<p><b>Push-button - Wire Diameter Selection:</b> Wire diameter 0.8mm, 1.0mm or 1.2mm is selected when corresponding light is lit.</p>

### 3. Setting the Trigger Mode

#### 3.1. 2T Mode

This setting applies for short-spell welds and the responding current curve is depicted below:



**0~t1:** Press torch trigger. Gas pre-flow starts.

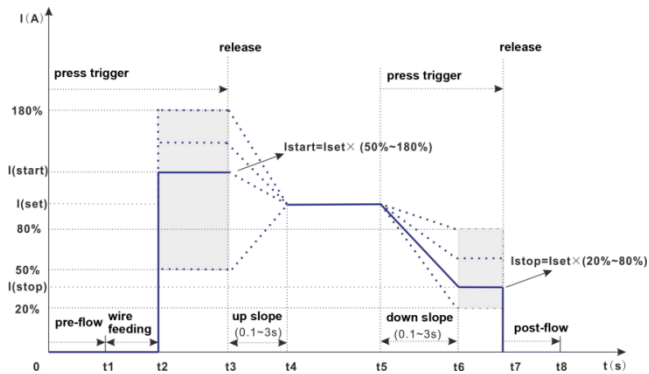
**t1~t2:** Wire feed starts. Gas flows.

**t2:** Welding operation starts and current reaches preset value.

**t3~t4:** Trigger released. Wire feeding stops and current drops to zero. Post-flow gas will continue for a short period. Note: the gas pre-flow and post-flow not adjustable in T2 mode.

### 3.2. 4T Mode

This mode is suited for longer spell welding operations and entail the following: arc start current, preset current, arc-stop current. The following represents the current, gas-flow and wire-feed curve when the 4T mode is selected:



**0~t1:** Press torch trigger. Gas pre-flow starts.

**t1~t2:** Wire feed starts and gas flows.

**t2~t3:** Welding operation starts and welding current reaches the arc-start current. If the trigger is not released, the operation will continue with the start current.

**t3~t4:** Trigger released and the welding current will reach the preset current in the upslope time.

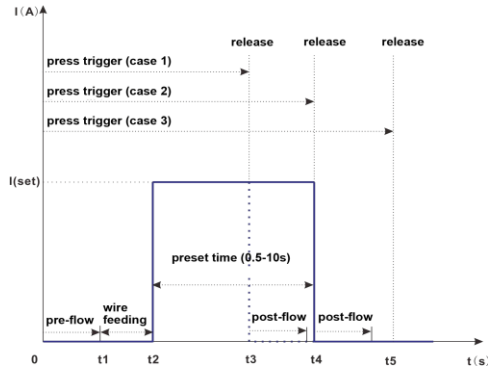
**t5~t7:** Trigger pressed again. Welding current will drop to the arc-ending value in preset downslope time. If the trigger is not released, the operation will continue on the arc-ending current value.

**t7~t8:** Trigger released. Wire feed stops, current drops to zero. Post gas flow will continue for a short period of time.

In the 4T mode pre-flow time, arc-start current, upslope time, downslope time, arc-ending current and post-flow time are adjustable individually.

### 3.3. Spot-welding Mode

In this mode, welding time can be preset and the diagram below depicts the activity:



0~t1: Press torch trigger. Gas pre-flow starts.

t1~t2: Wire feed starts and gas flows.

t2: Welding starts and the welding current reaches the preset value.

t3: Trigger released within the preset welding time, wire feed stops immediately and the current drops to zero. Gas post flow will continue for a short period of time. Note: The pre-flow and post-flow times not adjustable in the spot-welding mode.

t4/t5: Trigger released after the preset welding time, the operation will stop when the preset time has elapsed and the current drops to zero as post-flow will continue for a short period of time. Note: The pre-flow and post-flow times not adjustable in the spot-welding mode.

### 3.4. Continuous Spot-welding Mode

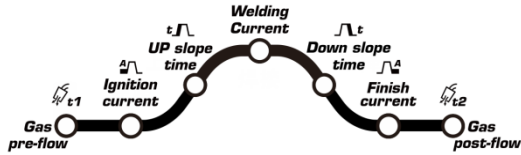
Select the **Spot Continuous** mode, press and hold the torch trigger for welding at the preset current for the duration of the operation. Spot time and spot interval work in a cycle and the welding operation stops when the trigger is released.

### 3.5. Robot Mode



Select the robot mode to allow communication between the welding machine and the welding robot.

#### 4. Auxiliary Welding Parameter Settings



Moving the menu button will allow selection of different parameters when the relevant light is lit.

Parameters	Default	Adjustable range
Pre-flow	0.1s	0.1s~5s
Ignition current	100A	20A~280A
Up slope	0.1s	0s~14.9s
Down slope	0.1s	0s~14.9s
Finish current	100A	20A~280A
Post-flow	1s	0.1s~5s

#### 5. Selection of Welding Wires

A variety of welding wires in a range of diameters can be selected. As a general rule  $\varnothing 1.0\text{mm}$  or  $\varnothing 1.2\text{mm}$  wire is used for welding aluminium and  $\varnothing 1.2\text{mm}$  is the recommended diameter. For copper, stainless steel and carbon steel material  $\varnothing 0.8\text{mm}$  or  $\varnothing 1.0\text{mm}$  wire can be used.

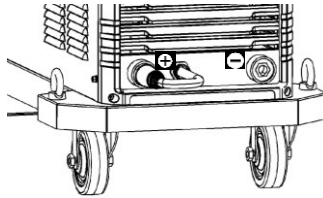
Welding process	Wire type	Diameter (mm)	Work piece material	Shielding gas
Pulsed MIG/MAG	Aluminum-silicon alloy	$\varnothing 0.8$ $\varnothing 1.0$ $\varnothing 1.2$	Soft aluminum: 4043,4047	$\geq 99.99\% \text{Ar}$
	Aluminum magnesium alloy	$\varnothing 1.2$	Hard aluminum: 5356,5183,MgAl5	$\geq 99.99\% \text{Ar}$
	Copper	$\varnothing 0.8$ $\varnothing 1.0$ $\varnothing 1.2$	Cu18,Cu19,CuSi3, CuAl9	$\geq 99.99\% \text{Ar}$
	Stainless steel	$\varnothing 1.0$ $\varnothing 1.2$	304,316,312,308	$98\% \text{Ar} + 2\% \text{CO}_2$
	Carbon steel	$\varnothing 1.2$		$80\% \text{Ar} + 20\% \text{CO}_2$
Synergic MIG/MAG	Carbon steel	$\varnothing 0.8$ $\varnothing 1.0$		$100\% \text{CO}_2$



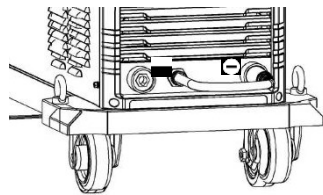
# Working Principle

## 1. Three Ways to Connect the Polarity Reversal Cable

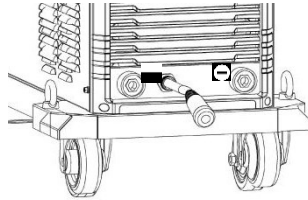
### 1.1. General Connection (Welding Mode: Pulse/double pulse)



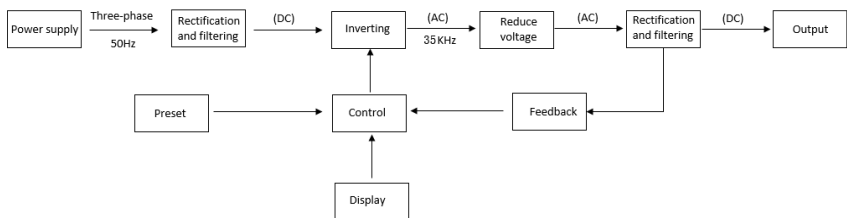
### 1.2. Flux-cored Welding (Welding Mode: MIG/MAG) :



### 1.3. MMA Welding (Welding Mode: MMA) :



## 2. Diagram Explaining Working Principle



2.1. A bridge rectifier converts AC to DC;

2.2. Controlled by PWM, the IGBT inverts the DC to 33Khz AC and transmits it through a high-frequency transformer;

2.3. After secondary rectification and reactor filtering, the output current is sufficient to

- meet the welding requirements;
- 2.4. The in-time protection circuit provides signals to the PWM warning for overheat and over-current situations;
  - 2.5. The closed-loop control method is adopted to make the welding power source have good anti-grid fluctuation ability and excellent welding performance.

## **Installation and Wiring**

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### **1. Location Requirements**

- 1.1. The machine should not be installed in an area where it is exposed to direct sunlight or rain but where the humidity is as low as possible and the ambient temperature is within the range of -10 °C - 40 °C.
- 1.2. The machine should be installed on a flat, preferable level surface but, in any case not on a surface with an inclination of more than 10 degrees.
- 1.3. The machine should not be operated in a work station exposed to wind. Should a windy environment be unavoidable, suitable screening should be installed.
- 1.4. In order to allow for efficient ventilation, a clear space of at least 20cm should be allowed in front of and behind the machine as well as at least 10cm at each side.




### **2. Power Input Requirements**

The power supply waveform should be the standard sin wave, the rated voltage 380V±10% 50/60Hz. Three phase voltage unbalance should be ≤ 5%.

<b>Parameters</b>	<b>Value</b>
<b>Input power</b>	AC380V±10% 50/60Hz 3PH
<b>Min. grid capacity</b>	6.2kVA
<b>Min. electric generator capacity</b>	10kVA
<b>Fuse:</b>	10A
<b>Circuit breaker:</b>	20A
<b>Input cable:</b>	≥3mm <sup>2</sup>
<b>Output cable:</b>	35mm <sup>2</sup>
<b>Ground cable:</b>	≥1.5mm <sup>2</sup>

Note: The specifications of fuse and circuit breaker in the above table are for reference only.

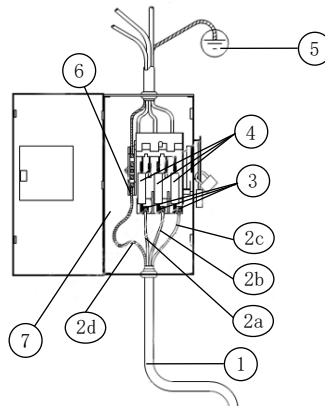
### 3. Main Power Supply Connection

		
	<b>Pay attention to prevent electric shock</b>	<b>Wear goggles</b>

**Warning:** Take note of the following when the welding machine is connected to the main power supply:





- 3.1. The connection must be carried out by a qualified electrician or technician.
- 3.2. The connection must be in compliance with national and local regulations.
- 3.3. Before the connection is carried out, the main power supply to the control box must be switched off.
- 3.4. An earth cable set must be securely connected from the machine to the work-piece. The machine must be earthed.
- 3.5. Ensure that the required power supply of the machine (as printed on its nameplate) corresponds to the main power supply.
- 3.6. The connection screws on the terminal block must be tight ensuring a solid connection between the machine cable wires and the main power supply.
- 3.7. The correct wiring procedure is explained in the following diagram:

Wiring of Three Phase AC, 50/60Hz Welding Machine



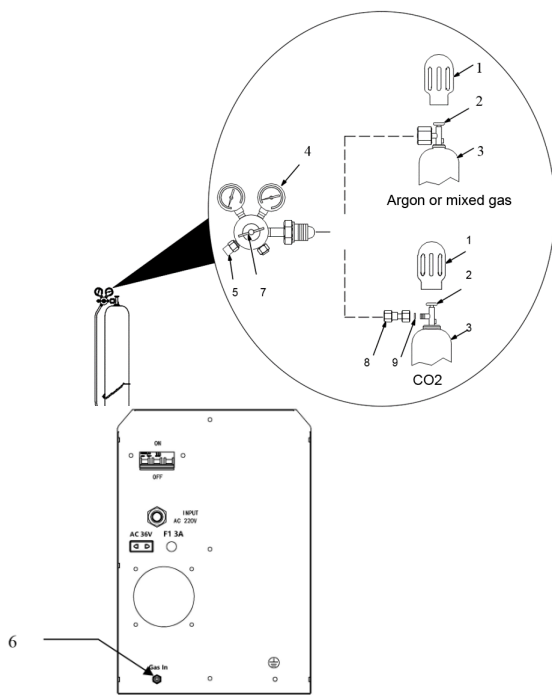
No.	Item	No.	Item
1	Power cord	3	Terminal block
2a	Live wire L1	4	Overcurrent protection device
2b	Live wire L2	5	GND
2c	Live wire L3	6	Earth wire terminal block
2d	Earth wire	7	Electric control box

#### 4. Gas-cylinder Connection

			
	<b>Explosion hazard</b>	<b>Prevent gas inhalation</b>	<b>Wear goggles</b>

**Warning: The following safety instructions are important when connecting a gas cylinder to the welding machine.**

- 4.1. The cylinder must be fixed upright to a wall, cylinder rack or support. Its centre of gravity can cause the cylinder to topple resulting in injury and material damage.
- 4.2. The cylinder must be placed out of reach of the operator and not in contact with the work table, work-piece or the welding machine.
- 4.3. Position yourself beside the valve and remove the air valve cover. ① Carefully open the valve slowly. ② slightly allow the gas flow to clear the valve outlet from dust and dirt ②.
- 4.4. Mount the flowmeter ④ to the cylinder ③.
- 4.5. Connect the gas hose firmly from the flowmeter outlet ⑤ to the gas inlet ⑥ situated at the back of the welding machine. Gas leakage is not allowed.
- 4.6. Adjust the flowrate in accordance with the manufacturer's recommendation. Generally, 15 -20 litres/min.

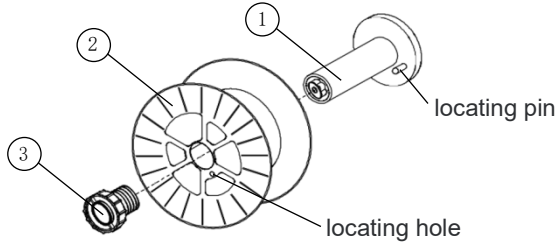


No.	Item	No.	Item
1	Cylinder valve cover	6	Gas inlet
2	Cylinder valve	7	Flowrate regulating valve
3	Gas cylinder	8	CO <sub>2</sub> adapter
4	Flowmeter	9	O ring
5	Flowmeter outlet		

## 5. Installation and Adjustment of Wire Spool

### 5.1 Installation of Wire Spool

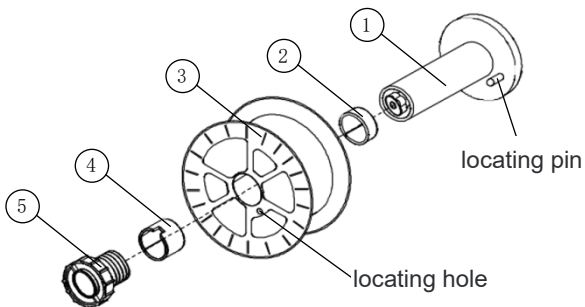
Installation of 15kg (Ø300mm) wire spool



No.	Item	No.	Item
1	Wire spool hub shaft	3	Hub nut
2	Wire spool		

Align the locating pin on the shaft① with the locating hole on the spool②, slide the spool② onto the hub shaft① and fasten the hub nut③ as explained below in clause 5.2.

Installation of 5kg (Ø200mm) Wire Spool



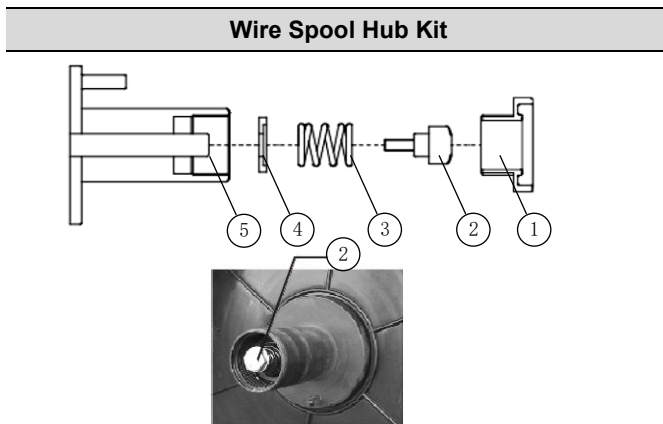
No.	Item	No.	Item
1	Wire spool hub shaft	4	Sleeve B
2	Sleeve A	5	Fixing nut
3	Wire spool		

Install sleeve A② and sleeve B④ into the spool ends③ and align the locating pin

on the shaft① with the locating hole on the spool③ and slide the spool③ onto the hub shaft① and fasten the hub nut⑤ as explained below in clause 5.3.

### 5.2. Brake Force Tension Adjustment

Applying a hexagon socket wrench, adjust the screw fastener② to adjust the braking tension of the spool. If the tension is too loose then the wire will unravel once the spool stops. If the tension is too tight it will increase motor load.



No.	Item	No.	Item
1	Hub nut	4	Limit stop
2	Screw fastener	5	Wire spool hub shaft
3	Speed limit spring		

## 6. Wire Feeder

### 6.1. Composition



No.	Item	No.	Item
1	Pressure regulating handle	3	Drive roll
2	Tensioner roller		

### 6.2. Selection of Tensioner Roller and Drive Roll

	Non-groove	U groove	Non-groove
<b>Tensioner roller</b>			
<b>Drive roll</b>			
	V groove	U groove	knurled
<b>V groove roll:</b>	Suited for hard wires such as carbon steel and stainless steel wire.		
<b>U groove roll:</b>	Suited for soft wires such as aluminium and aluminium alloy wires.		
<b>Knurled roll:</b>	Suited for flux-cored wires.		

### 6.3. Wire-feed Pressure Selection

The wire-feed pressure scale is etched on the pressure-regulating handle① and prescribes the approximate pressure scale to be selected for use on different wire materials and diameters



Scale Table				
	Diameter			
	Pressure	Ø0.8mm	Ø1.0mm	Ø1.2mm
	Drive roll			
	V groove roll	2	2	2
4	U groove roll	1.5	1.5	1.5
Pressure scale	Knurled roll			2

The actual pressure scale to be used will be determined by the length of the torch cable, the type of welding torch and welding wire as well as wire-feeding conditions. After adjustment of the drive roll, press the tensioner roller. Should the wire slip when exiting the contact tip, readjust.

**! However:**




- ◆ **Take care not to apply excessive pressure which will result in wire being deformed and coatings being damaged.**
- ◆ **Excessive pressure will also result in faster drive-roll wear.**

## 7. Installation of Wire Liner and MIG Torch




In order to ensure a smooth and successful welding operation, it is important that the correct liner and contact tip be installed.

Guide-tube Material	Wire Hardness	Welding Wire Type
Steel	Hard	Solid carbon steel, stainless steel
Teflon	Soft	Aluminum, aluminum alloy, copper, copper alloy

## 7.1 Installation of Steel Wire Guide-tube

		
<p>① Install the steel wire liner into the welding torch</p>	<p>② Insert the wire guide tube into the Euro adapter</p>	<p>③ Set up the welding torch into the Euro adapter</p>





## 7.2. Teflon Wire Liner Installation

		
<p>① Install the Teflon wire liner into the torch leaving approximately 60mm of the liner outside the torch.</p>	<p>② Set up the welding torch into the Euro adapter</p>	<p>③ Wire liner should be left about 5mm outside</p>

### ! Take care:

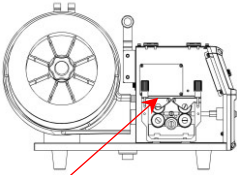
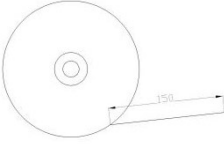
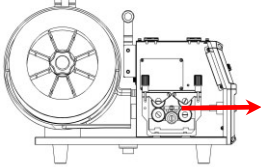
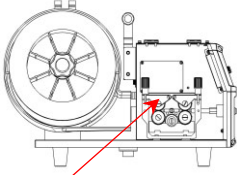
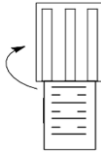

- ◆ Ensure the wire liner is not too tight or too loose else this will increase the feeding resistance resulting in feeding instability.
- ◆ Ensure all torch quick-connectors are securely tightened. Loose connections will cause a voltage drop resulting in overheated equipment.

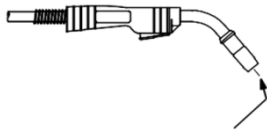
## 8. Installation and Adjustment of Welding Wire

			
	<p>Prevent injuries caused by wire</p>	<p>Prevent injuries caused by moving parts</p>	<p>Wear goggles</p>

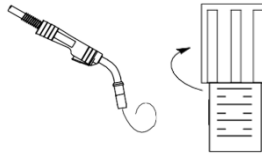
**! Take care:**

- ◆ The wire speed generated by the feeder is relatively fast and safety during the installation and adjustment process is of prime importance. Never point the welding torch nozzle to a face or other body part. The speed of the wire exiting the nozzle can cause a nasty job.

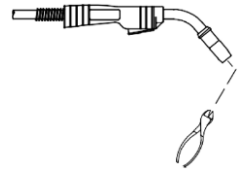
Installation Steps		
 <p>a. Open the tensioner roller.</p>	 <p>b. Pull approximately 150mm wire from the spool.</p>	 <p>c. Feed the wire through the wire feeder, into the torch and tighten the wire by hand.</p>
 <p>d. Close the tensioner and feed the wire by pressing the manual wire-feed button.</p>	 <p>e. Rotate the pressure regulating handle to adjust the tension on the welding wire in accordance with the guideline parameters in table 6.3.</p>	 <p>f. Remove the contact tip to allow the wire to freely feed through the torch.</p>



g. Reinstall the contact tip after the wire has emerged from the torch.



h. In order to avoid slipping, recheck the wire-feeding pressure and adjust if required.



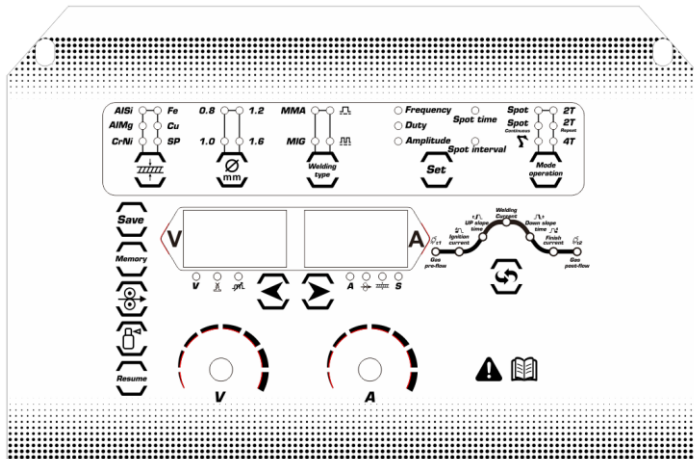
i. Allow approximately 10 to 15mm wire outside the contact tip and cut the excess.







## Brief Procedure for Welding Operation






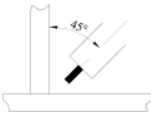
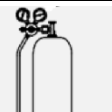
### 1. Preparation before welding

- 1.1. Wear the necessary welding protection equipment such as helmet, mask, earplugs, protective clothing, gloves, insulating safety shoes.
- 1.2. Confirm the electrical grid connected to the welding machine is consistent with the correct power supply of the machine.
- 1.3. Confirm the gas in the gas cylinder is sufficient, no damage to the gas hose and flowmeter.
- 1.4. Confirm that the insulation layers on all the wires and cables of the welding machine are intact and that the cable set is secure and correctly connected to the machine.
- 1.5. Confirm the machine is freely vented and that the vents on the machine are not obstructed and no objects are lying on the machine body.
- 1.6. Switch on the machine and ensure the indicator light is lit and the fan is operational.
- 1.7. Press the manual wire feeding button and make sure it is operating correctly.
- 1.8. Set the required parameters on the control panel, press the trigger switch on the torch and ensure wire feed and gas flow is operational.

## 2. Welding Process When Welding Aluminium



Steps	Content	Description
1		Securely connect the welding torch and earth cable set to the machine.
2		Ensure the earth clamp is connected near the welding zone.
3		Select the suitable spool of wire and mount it over the feeder hub as explained in clause 5.1.
4		Check the brake force tension is sufficient as explained in clause 5.2.
5		Select the suitable drive roll and tensioner rollers as explained in clause 6.2. Adjust the pressure as explained in clause 6.3.
6		Allow approximately 10 to 15mm wire outside the contact tip and cut the excess

7		<p>Select an appropriate welding wire. If using 4043, choose AISi for soft aluminium wire.</p>
8		<p>Select Ø1.2mm welding wire.</p>
9		<p>Select single pulse mode</p>
10		<p>Select 2T mode (No arc extinguish )</p>
11		<p>Adjust the current to a suitable value based according to the workpiece thickness.</p>
12		<p>According to the actual position of the welding area, keep the torch tilted in a certain angle against the welding bead. If the two work pieces form an angle of 90°, the angle between the torch and the work piece should be about 45° and about 60° between the torch and welding seam. If the two work pieces are in flat welding position, the torch should be perpendicular to the metal sheet and about 60° between the torch and welding seam. Press the trigger to start welding.</p>
13		<p>Once the welding job is finished, close the gas cylinder valve and turn off the machine's power supply..</p>

# Maintenance

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Safe operation of the machine is dependent on regular maintenance and the replacement of worn and defective parts where necessary.

## 1. Daily Precautionary Checks:

- 1.1. For any abnormal vibrations, sounds or odours.
- 1.2. For any sign of overheating on cable connections
- 1.3. Whether the power switch is operational and the fan operates smoothly when the machine is switched on.
- 1.4. Whether cables are correctly connected, insulated and in sound order.
- 1.5. Torch consumables are subject to wear and tear and should be replaced when worn.

## 2. Three to Six Monthly Check List

### 2.1. Dust Removal

Remove the side cover plate and clean off all parts with dry compressed air. Since the effective cooling of the machine is dependent on a designed air flow pattern, it is important to return the side cover plate after the cleaning operation. Not paying attention to this detail, will result in over-heating of and consequent damage to the transformer and semi-conductor parts.


### 2.2. Wire Feeder Parts

The guide tube, drive rolls and tensioner rollers are subject to wear and tear parts and should be checked and replaced if worn.

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## Common Machine Malfunctions and Solutions

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 **Warning: Machine maintenance and repair must be carried out by qualified technicians. The operating voltage in the machine can be up to 600V and it is important that power be cut at the machine and at the control box before covers are removed and repairs carried out. A cooling-down period of at least 5 minutes is required before commencement of any inspection and repairs. This will allow the capacitor to fully discharge.**

## 1. Inspection Before Overhaul

- 1.1. Check if the line voltage on the three-phase power supply is within the range of 340V - 420V and, that all phases on a three-phase system are intact.
- 1.2. Check if the power cable as well as the earth wire is firmly connected.
- 1.3. Check whether the wiring connections are correct and firmly connected.

## 2. Common Machine Problems and Troubleshooting:

No.	Problem	Root Cause	What to do
1	Machine is switched on but indicator light not lit.	One of power supply phases down.	Check power supply phases and rectify.
		Automatic air switch damaged.	Replace the automatic air switch.
		Blown fuse.	Replace fuse.
2	Machine switched on, auto air switch trips immediately.	Failure of auto air switch.	Replace auto air switch.
		IGBT damaged	Replace IGBT and drive circuit board.
		Three-phase bridge rectifier damaged.	Replace three phase bridge rectifier
		Varistor damaged.	Replace the varistor.
		Machine control board damaged.	Replace the control board.
3	Auto air switch trips during welding process.	Long-term overload.	Machine to be operated in accordance with duty cycle.
		Auto air switch damaged.	Replace the auto air switch.
4	Welding current not adjustable.	Broken control cable of wire feeder or controller.	Replace wire feeder control cable or the controller.
		Control board damaged.	Replace the control board.
		Wire at both ends of the diverter inside the machine is broken.	Replace the broken wire.



No.	Problem	Root Cause	What to do
5	Unstable arc and excessive spatter	Welding parameters do not match or irregular operation.	Readjust welding parameters or improve operation.
		Badly worn contact tip.	Replace contact tip.
6	CO <sub>2</sub> regulator does not heat gas.	CO <sub>2</sub> regulator damaged.	Replace CO <sub>2</sub> regulator
		Broken or short-circuited heating cable.	Repair heating cable.
		Blown thermistor on the heating supply.	Replace the thermistor.
7	When torch trigger is pressed and held, wire feed is normal but no gas flow.	Damaged control circuit board.	Replace the control circuit board.
		Damaged solenoid valve.	Replace the solenoid valve.
8	When torch trigger is pressed and held, wire feeder fails and there is no indication of open circuit voltage.	Torch switch damaged.	Replace the torch.
		Broken wire feeding control.	Repair the wire feeding control cable.
		Damaged control circuit board.	Replace the control circuit board.

### 3. Common Welding Imperfections and Analysis

No.	Imperfect	Root Cause
1	Porosity or undercut	<ol style="list-style-type: none"> <li>1. Impure gas or insufficient gas supply.</li> <li>2. Absorption of air during welding.</li> <li>3. Failed preheater.</li> <li>4. Poor gas shielding owing to strong wind.</li> <li>5. Torch nozzle blocked by spatter.</li> <li>6. Too great a distance between nozzle and workpiece.</li> <li>7. Polluted welding surface with oil and dust or moisture caused from insufficient cleaning not sufficiently removed.</li> <li>8. Arc length too long and voltage too high.</li> <li>9. Insufficient silicon and manganese content in welding wire.</li> </ol>
2	Poor welding bead	<ol style="list-style-type: none"> <li>1. Welding parameters unsuitable for the current job.</li> <li>2. Welding wire out of position and not aligned with the centre of the welding bead.</li> <li>3. Centre deviation of wire feed roller.</li> <li>4. Wire straighteners not properly adjusted.</li> <li>5. Loose or worn contact tip.</li> </ol>
3	Incomplete penetration	<ol style="list-style-type: none"> <li>1. Low welding current and uneven wire-feed speed.</li> <li>2. Arc voltage too low or too high.</li> <li>3. Inside the beveled edge the welding speed is too slow or too fast.</li> <li>4. Beveled gap too small.</li> <li>5. Welding wire out of position and not aligned with the centre of the welding bead.</li> </ol>

No.	Imperfect	Root Cause
4	Unstable welding arc	<ol style="list-style-type: none"> <li>1. Loose or worn contact tip or too large in diameter for the wire thickness.</li> <li>2. Uneven wire spool rotation: excessive wear on the groove of the drive roll and the pressure from the tensioner roller not adequate.</li> <li>3. Too low welding current and fluctuation of arc voltage.</li> <li>4. Protruding welding wire outside the the contact tip too long.</li> <li>5. Surface pollution of the workpiece from rust, paint or grease.</li> <li>6. The earth cable set not properly connected.</li> </ol>